What is claimed is:

1. An inductive coupler for a wired pipe joint, comprising:

a first flux-loop inductive coupler element including a ring-like first core having high magnetic permeability, said first core defining a first axis, a first exterior substantially cylindrical face, and a first interior conical-section annular face, the first interior face defining a first larger-diameter face, a first smaller-diameter face, and an annular first groove, the first groove located between the first larger-diameter face and the first smaller-diameter face, and a first electrically conductive coil wound within said first groove; and

a second flux-loop inductive coupler element including a ring-like second core having high magnetic permeability, said second core defining a second axis, a second interior substantially cylindrical face and a second exterior conical-section annular face, the second exterior face defining a second smaller-diameter face, a second larger-diameter face, and an annular second groove, the second groove located between the second smaller-diameter face and the second larger-diameter face, and a second electrically conductive coil wound within said second groove;

wherein said first and second elements are adapted to mate with first larger-diameter face facing second larger-diameter face, and first smaller-diameter face facing second smaller-diameter face;

whereby said first and second cores form a low-reluctance closed ring-like magnetic path around said first and second coils.

2. An inductive coupler according to claim 1, wherein the first interior conical-section annular face defines a conical shape with an apex on the first axis, and the second exterior conical-section annular face defines a conical shape with an apex on the second axis.

3. An inductive coupler according to claim 1, wherein each core defines a conduit for passage of at least one electrical cable coupled to its coil.

4. A first flux-loop inductive coupler element for electrical coupling with a second flux-loop inductive coupler element, said first flux-loop inductive coupler element comprising:

a ring-like core having high magnetic permeability and a conical-section annular face transverse to the plane of said core, the conical-section annular face having an annular groove dividing the conical-section annular face into a larger-diameter conical-section annular face and a smaller-diameter conical-section annular face; and

a coil wound within the annular groove.

5. An inductive coupler element according to claim 4, further comprising a tubular support member adapted to mount said inductive coupler element within the bore of a wired pipe joint.

6. An inductive coupler element according to claim 4, wherein said core defines a conduit for passage of at least one electrical cable coupled to said coil.

7. An inductive coupler element according to claim 4, wherein said coil does not substantially protrude forward of the conical face.

8. A wired pipe joint, comprising:

an elongate tubular shank defining an axial bore and first and second ends;

electrical coupling means for providing electrical coupling from a location in the first end of said shank to a location in the second end of said shank;

a first flux-loop inductive coupler element located within the first end of said shank and connected to a first end of said electrical coupling means; and

a second flux-loop inductive coupler element located within the second end of said shank and connected to a second end of said electrical coupling means;

wherein each flux-loop inductive coupler element includes a ring-like core having a high magnetic permeability and a conical-section annular face transverse to the plane of said core, the conical-section annular face having an annular groove dividing the conical-section annular face into a larger-diameter conical-section annular face and a smaller-diameter conical-section annular face; and an electrically conductive coil wound within the annular groove.

9. A wired pipe joint according to claim 8, further comprising a first tubular support member adapted to mount said first inductive coupler element within the first end of the axial bore, and a second tubular support member adapted to

mount said second inductive coupler element within the second end of the axial bore.

10. A wired pipe joint according to claim 8, wherein said ring-like core defines a conduit for passage of at least one electrical cable coupled to said coil.

11. A current-loop inductive coupler for a wired pipe joint having an axial bore, the current-loop inductive coupler comprising:

a first pipe joint end having a first shaped surface encircling the bore, the first pipe joint end having a first layer of high-conductivity, low-permeability material on the first shaped surface defining a first shaped belt;

a first ring-like core concentric with, fixedly attached to, and partially enclosed by said first shaped belt;

a first electrically conductive coil wound about said first ring-like core;

a second pipe joint end having a second shaped surface encircling the bore, the second pipe joint end having a second layer of high-conductivity, low-permeability material on the second shaped surface defining a second shaped belt;

a second ring-like core concentric with, fixedly attached to, and partially enclosed by said second shaped belt;

a second electrically conductive coil wound about said second ring-like core; and

electrical coupling means for coupling said first coil to said second coil.

12. A current-loop inductive coupler element, comprising:

a first pipe joint end of a first pipe joint defining an axial bore, the first pipe joint end having a first shaped surface encircling the bore, said first shaped surface having a first layer of high-conductivity, low-permeability material thereon to form a first shaped belt;

a first ring-like core concentric with, fixedly attached to, and partially enclosed by said first shaped belt; and

a first electrically conductive coil wound about said first ring-like core;

wherein said first shaped belt is shaped to cooperate with a second shaped belt of an adjacent second pipe joint end of a second pipe joint, said second shaped belt partially enclosing a second electrically conductive coil, such that the two

shaped belts form a closed toroidal electrical conducting path enclosing said first coil and said second coil when said first pipe joint and said second pipe joint are mated.

13. A current-loop inductive coupler element according to claim 12, wherein said first ring-like core is made of a material selected from a group of materials, the group consisting of Supermalloy and Metglas.

14. A current-loop inductive coupler element according to claim 12, wherein said high-conductivity, low-permeability material is a material selected from a group of materials, the group consisting of copper, brass, bronze, beryllium copper, silver, aluminum, gold, tungsten, and zinc.

15. A current-loop inductive coupler element according to claim 12, wherein each ring-like core is mounted proximate to a pipe joint sealing face.

16. A wired pipe joint having an axial bore, the wired pipe joint comprising:

an elongate tubular shank having a first high-conductivity, low-permeability shaped belt at a shank first end, and a second high-conductivity, low-permeability shaped belt at a shank second end, both shaped belts concentric with the axial bore;

a first ring-like core, concentric with and partially enclosed by said first shaped belt;

a first electrically conductive coil wound about said first ring-like core;

a second ring-like core, concentric with and partially enclosed by said second shaped belt;

a second electrically conductive coil wound about said second ring-like core; and

electrical coupling means for coupling said first coil to said second coil.

17. A wired pipe joint according to claim 16, wherein said first ring-like core is made of a material selected from a group of materials, the group consisting of Supermalloy and Metglas®.

18. A wired pipe joint according to claim 16, wherein said first high-conductivity, low-permeability shaped belt includes a material selected from a group of materials, the group consisting of copper, brass, bronze, beryllium copper, silver, aluminum, gold, tungsten, and zinc.

19. A wired pipe joint according to claim 16, wherein each ring-like core is mounted proximate to a pipe joint sealing face.

20. A wired pipe joint having an axial bore, the wired pipe joint comprising:

an elongate tubular shank made of a high-conductivity, low-permeability material, the shank defining a first shaped belt at a shank first end, and a second shaped belt at a shank second end, both shaped belts concentric with the axial bore;

a first ring-like core, concentric with and partially enclosed by said first shaped belt;

a first electrically conductive coil wound about said first ring-like core;

a second ring-like core, concentric with and partially enclosed by said second shaped belt;

a second electrically conductive coil wound about said second ring-like core; and

electrical coupling means for coupling said first coil to said second coil.

21. A wired pipe joint according to claim 20, wherein said first high-conductivity, low-permeability material is a material selected from a group of materials, the group consisting of copper, brass, bronze, beryllium copper, silver, aluminum, gold, tungsten, and zinc.

22. A current-loop inductive coupler for a wired pipe joint having an axial bore, the current-loop inductive coupler comprising:

a first pipe joint end having a first shaped surface encircling the axial bore, said first pipe joint end having a first layer of high-conductivity, low-permeability material on the first shaped surface defining a first shaped belt;

a first tubular support member attached within the bore to the first pipe joint end;

a first ring-like core concentric with, supported by, and partially encircling said first tubular support member such as to radially face said first shaped belt;

a first electrically conductive coil wound about said first ring-like core;

a second pipe joint end having a second shaped surface encircling the axial bore, said second pipe joint end having a second layer of high-conductivity, low-permeability material on the second shaped surface defining a second shaped belt;

a second tubular support member attached within the bore to the second pipe joint end;

a second ring-like core concentric with, supported by, and partially encircling said second tubular support member such as to radially face said second shaped belt;

a second electrically conductive coil wound about said second ring-like core; and

electrical coupling means for coupling said first coil to said second coil.

23. A current-loop inductive coupler element, comprising:

a first pipe joint end of a first pipe joint defining an axial bore, the first pipe joint end having a first shaped surface encircling the bore, said first shaped surface having a first layer of high-conductivity, low-permeability material thereon to form a first shaped belt;

a first tubular support member attached within the bore to the first pipe joint end;

a first ring-like core concentric with, supported by, and partially encircling said first tubular support member such as to radially face said first shaped belt;

a first electrically conductive coil wound about said first ring-like core;

wherein said first shaped belt is shaped to cooperate with a second shaped belt of an adjacent second pipe joint end of a second pipe joint, said second shaped belt partially enclosing a second electrically conductive coil, such that the two tubular support members and the two shaped belts form a closed toroidal electrical conducting path enclosing said first coil and said second coil when said first pipe joint and said second pipe joint are mated.

24. A current-loop inductive coupler element according to claim 23, wherein said first ring-like core is made of a material selected from a group of materials, the group consisting of Supermalloy and Metglas®.

25. A current-loop inductive coupler element according to claim 23, wherein said high-conductivity, low-permeability material is a material selected from a group of materials, the group consisting of copper, brass, bronze, beryllium copper, silver, aluminum, gold, tungsten, and zinc.

26. A wired pipe joint having an axial bore, the wired pipe joint comprising:

an elongate tubular shank having a first high-conductivity, low-permeability shaped belt at a shank first end, and a second high-conductivity, low-permeability shaped belt at a shank second end, both shaped belts concentric with the axial bore;

a first tubular support member attached within the bore to the first pipe joint end;

a first ring-like core concentric with, supported by, and partially encircling said first tubular support member such as to radially face said first shaped belt;

a first electrically conductive coil wound about said first ring-like core;

a second tubular support member attached within the bore to the second pipe joint end;

a second ring-like core concentric with, supported by, and partially encircling said second tubular support member such as to radially face said second shaped belt;

a second electrically conductive coil wound about said second ring-like core; and

electrical coupling means for coupling said first coil to said second coil.

27. A current-loop inductive coupler element according to claim 26, wherein said first ring-like core is made of a material selected from a group of materials, the group consisting of Supermalloy and Metglas®.

28. A current-loop inductive coupler element according to claim 26, wherein said high-conductivity, low-permeability material is a material selected from a group of materials, the group consisting of copper, brass, bronze, beryllium copper, silver, aluminum, gold, tungsten, and zinc.

30. A wired sub having an axial bore, the wired sub comprising:

a short tubular shank made of a high-conductivity, low-permeability material, the shank defining a first shaped belt at a shank first end, and a second shaped belt at a shank second end, both shaped belts concentric with the axial bore;

a first ring-like core, concentric with and partially enclosed by said first shaped belt;

a first electrically conductive coil wound about said first ring-like core;

a second ring-like core, concentric with and partially enclosed by said second shaped belt;

a second electrically conductive coil wound about said second ring-like core; and

electrical coupling means for coupling said first coil to said second coil.

31. A wired sub according to claim 30, wherein said first high-conductivity, low-permeability material is a material selected from a group of materials, the group consisting of copper, brass, bronze, beryllium copper, silver, aluminum, gold, tungsten, and zinc.

32. A wired sub having an axial bore, the wired sub comprising:

a short tubular shank made of a high-conductivity, low-permeability material, the shank defining a shaped belt at a shank end concentric with the axial bore;

a ring-like core, concentric with and partially enclosed by said shaped belt; and

an electrically conductive coil wound about said first ring-like core.